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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,183	02/09/2004	Kia Silverbrook	MTB22US	8428

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EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	**PAPER NUMBER**
2861	

DATE MAILED: 07/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,183	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22,24-27,29-44 and 46-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22,24-27,29-44 and 46-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *2/9/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 17, 36, and 53 is withdrawn in view of the newly discovered reference(s) to De Moor et al. Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4, 5, 11, 13, 17, 19, 20, 22, 24, 30, 32, 36, 38, 39, 41, 42, 47, 50, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (US 6761433 B2) in view of De Moor et al.

Moon et al. teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 2, lines 1-4*) and printing system (*col. 5, lines 60-65*) comprising:

a plurality of nozzles (*elements 108, Figure 4*), each nozzle having a respective bubble forming chamber (*col. 5, line 41*); at least one heater element disposed in each of the bubble forming chambers respectively (*col. 6, lines 7-8*), the heater element configured for thermal contact with a bubble forming liquid (*Figure 10*);

supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (*inherent to operating the inkjet printer of the present invention*);

drive circuitry corresponding to each of the nozzles for controlling the operation of the heater element (*col. 2, lines 34-37*); such that,

heating a mass of solid material incorporated in the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 4, lines 45-50*); wherein,

part of the drive circuitry is disposed on one side of the bubble forming chamber (*elements 105 to the left of line B-B, Figure 5A*), and part of the circuitry is formed on the opposing side of the bubble forming chamber (*elements 105/106 to the right of line B-B, Figure 5A*)

***regarding claims 2, 20, and 39**, the heater elements and bubble forming chambers are symmetrical about a longitudinal plane (*Figure 9*)

***regarding claims 4, 22, and 41**, the gas bubble encircles at least some of the heater element (*bubble 401 encircles unreferenced heater element, illustrated as black blocks, Figure 12*)

***regarding claims 5, 24, and 42**, the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 6, lines 22-25*)

***regarding claims 11, 30, and 47**, each heater has two opposite sides (*unreferenced elements, illustrated as black blocks, Figures 10-13*) and is configured such that a gas bubble formed by that heater element is formed at both of the sides of that heater element (*Figures 11-12*)

***regarding claims 13, 32 and 50**, the printhead is comprised of a structure that is formed by chemical vapor deposition (*col. 9, lines 3-5*), the nozzles being incorporated on the structure (*nozzle plate 108, Figure 4*)

***regarding claims 17, 36, and 53**, each heater element is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 4, lines 45-50*)

Moon et al. do not expressly teach the following:

***regarding claims 1, 19, and 38**, the heater element is less than 10 nanograms

***regarding claims 17, 36, and 53**, each heater element is configured for a mass of less than two nanograms

De Moor et al. teach the following:

***regarding claims 1, 17, 19, 36, 38, and 53**, each heater element is configured for a mass of less than two nanograms (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element into Moon et al.'s invention. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Claims 1, 6, 8, 10, 14, 17, 19, 25, 27, 29, 33, 36, 38, 43, 44, 46, 49, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of De Moor et al.

Silverbrook teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 5, lines 34-38*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*elements 41, Figure 3*), each nozzle having a respective bubble forming chamber (*element 112, Figure 9*); at least one heater element disposed in each of the bubble forming chambers respectively (*element 120, Figure 12*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*);

supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (*col. 12, lines 59-61*);

drive circuitry corresponding to each of the nozzles for controlling the operation of the heater element (*col. 2, lines 34-36*); such that,

heating a mass of solid material incorporated into the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); wherein,

part of the drive circuitry is disposed on one side of the bubble forming chamber and part of the circuitry is formed on the opposing side of the bubble forming chamber (*Figure 13 in conjunction with Figure 32 shows that the drive circuitry is connected on either side of the chamber 447*)

***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and to be a page-width printhead (*col. 2, lines 19-20*)

***regarding claims 8, 27, and 44**, each heater element is configured such that actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29 and 46,** the printhead comprises a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm:* $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$)

***regarding claims 14, 33, and 49,** the printhead comprises a structure which is less than 10 microns thick, the nozzles being incorporated on the structure (*col. 9, lines 8-10*)

***regarding claims 17, 36, and 53,** each heater element is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 9, lines 26-28*)

Silverbrook does not expressly teach the following:

***regarding claims 1, 19, and 38,** the heater element is less than 10 nanograms

***regarding claims 17, 36, and 53,** each heater element is configured for a mass of less than two nanograms

De Moor et al. teach the following:

***regarding claims 1, 17, 19, 36, 38, and 53,** each heater element is configured for a mass of less than two nanograms (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element into Silverbrook's invention. The motivation for

doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Claims 1, 6, 7, 15, 16, 17, 18, 19, 25, 26, 34, 35, 36, 37, 38, 43, and 51-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anagnostopoulos et al. (US 6502925 B2) in view of De Moor et al.

Anagnostopoulos et al. teach the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 7, lines 34-36*) and printing system (*col. 7, lines 14-15*) comprising:

a plurality of nozzles (*col. 5, lines 17-21*), each nozzle having a respective bubble forming chamber (*col. 5, lines 20-22*); at least one heater element disposed in each of the bubble forming chambers respectively (*col. 5, lines 22-25*), the heater element configured for thermal contact with a bubble forming liquid (*col. 5, lines 22-25*);

supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (*inherent to operating the inkjet printer of the present invention*);

drive circuitry corresponding to each of the nozzles for controlling the operation of the heater element (*col. 5, lines 12-15*); such that,

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 1, lines 37-41 in combination with col. 4, lines 22-25*); wherein,

part of the drive circuitry is disposed on one side of the bubble forming chamber (*contact 1, Figure 6*), and part of the circuitry is formed on the opposing side of the bubble forming chamber (*contact 2, Figure 6*)

***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and to be a page-width printhead (*col. 3, lines 35-39*).

***regarding claims 7, and 26**, each heater is in the form of a cantilever beam (*TiN heater, Figure 5*)

***regarding claims 15, 34, and 51**, the printhead comprises a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 5, lines 17-23*), and a plurality of the heater elements are disposed within each chamber (*col. 8, lines 36-37*), the heater elements within each chamber being formed on different respective layers to one another (*col. 8, lines 36-38*)

***regarding claims 16, 35, and 52**, each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54**, each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

***regarding claims 17, 36, and 53**, each heater element is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 1, lines 37-41 in combination with col. 4, lines 22-25*)

Anagnostopoulos et al. do not expressly teach the following:

***regarding claims 1, 19, and 38,** the heater element is less than 10 nanograms

***regarding claims 17, 36, and 53,** each heater element is configured for a mass of less than two nanograms

De Moor et al. teach the following:

***regarding claims 1, 17, 19, 36, 38, and 53,** each heater element is configured for a mass of less than two nanograms (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element into Anagnostopoulos et al.'s invention. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Claims 3, 12, 21, 31, 40, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (US 6761433) in view of De Moor et al., as applied to claim 1 above, and further in view of Campbell et al. (US 4870433).

Moon et al. teach the following:

***regarding claims 12, 31, and 48,** the bubble, which each element is configured to form, is collapsible and has a point of collapse (*col. 6, lines 63-66*)

Moon et al. do not teach the following:

***regarding claims 3, 21, and 40,** the bubble forming chamber has a circular cross-section, and the bubble will collapse on the central axis of the chamber

***regarding claims 12, 31, and 48,** the bubble has a point of collapse that is spaced from the heater element

Campbell et al. teach the following:

***regarding claims 3, 21, and 40,** the bubble forming chamber has a circular cross section (*unreferenced, circular, broken line, Figure 1*) wherein the heater element has at least one arcuate section (*element 12, Figure 3*) that is concentric with the longitudinal axis of the bubble forming chamber (*Figure 1*); such that during use, the arcuate section forms a disc shaped bubble with a point of collapse substantially on the central axis of the bubble forming chamber (*col. 3, lines 60-63*).

***regarding claims 12, 31, and 48,** the heater elements are configured such that the point of collapse of the bubble is spaced from the heater element (*col. 3, lines 60-64*).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Campbell et al.'s bubble point of collapse into the invention of Moon et al. modified by De Moor et al. The motivation for doing so, as taught by Campbell et al., is to prevent cavitational erosion of the resistive heater elements so that reliability is improved (*col. 3, lines 64-66*).

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vip Patel can be reached on (571) 272-2458. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

6/21/06
SLF

K. FEGGINS
PRIMARY EXAMINER
4/04